



**VERTICAL UNIT BOILER
TYPE VU-55**

COMBUSTION ENGINEERING, INC.

COMBUSTION ENGINEERING BUILDING • 200 MADISON AVE., NEW YORK

C - E T Y P E . . .

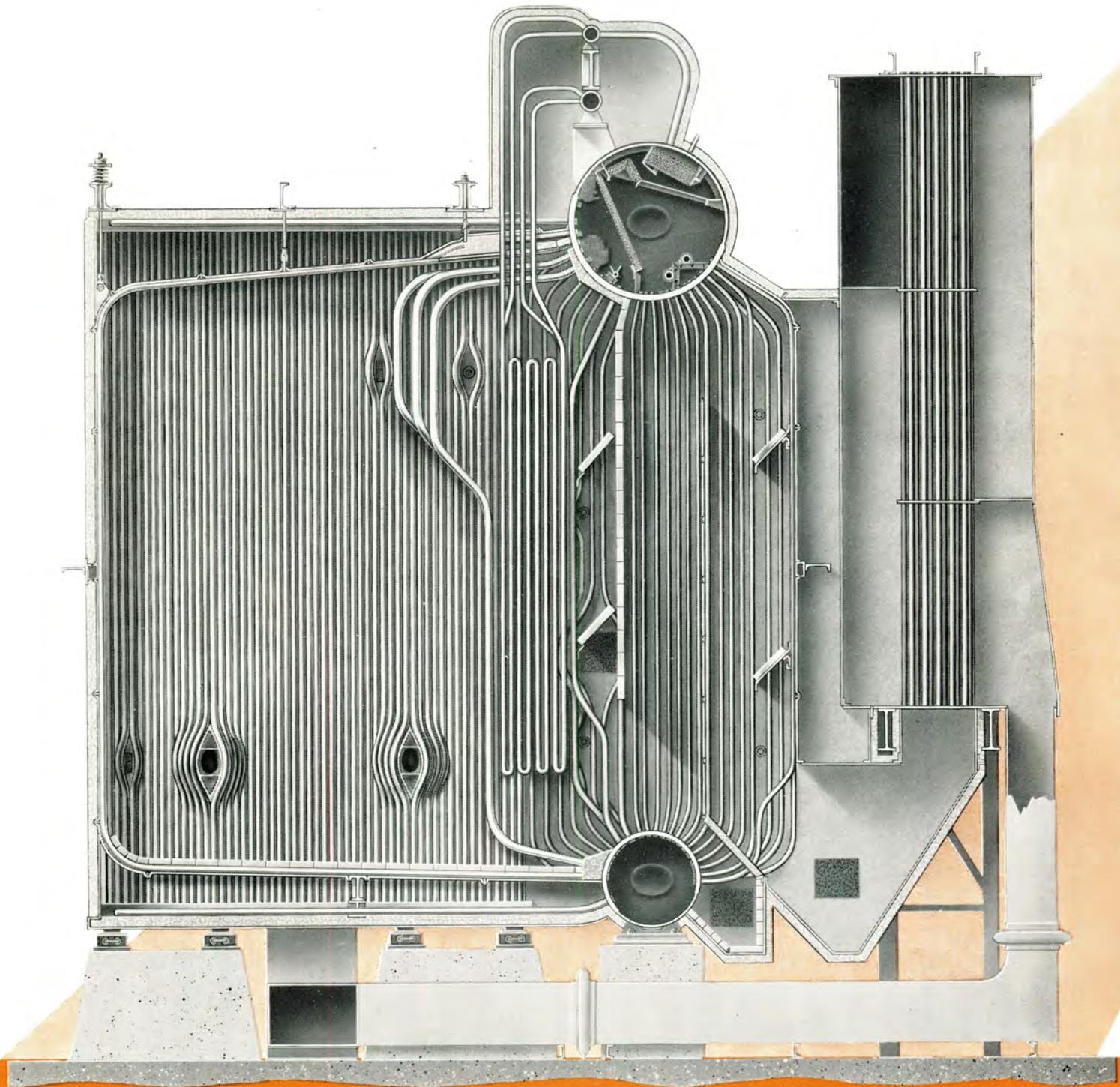


Fig. 1. Sectional side elevation of C-E Type VU-55 Boiler with C-E Superheater and C-E Tubular Air Heater. Boiler is completely bottom-supported and has double casing and C-E Tangential Burners.

VU-55

BOILER

BACKGROUND

The record of outstanding progress in design and performance of C-E Boilers covers three quarters of a century. During this time C-E designs have kept pace with the advances in metallurgy and have established many notable achievements in the field of steam generation. This distinctive record of progressive engineering, skilled craftsmanship, and worldwide operating experience is reflected in the advanced design of the VU-55 Boiler.

ADVANCED DESIGN

The development of the C-E line of VU-55 Boilers includes the latest and the best features of modern boiler design. Tangential firing, completely water-cooled walls and panel wall construction have been adapted from the most advanced C-E designs of large boilers to obtain improved design and performance in the VU-55 line. Pressure firing, allowing reduced operating costs and increased operating efficiency, is also featured in the new VU-55 boiler series.

The high, narrow furnace designed specifically for oil and gas firing; the integral arrangement of furnace, boiler and air heater; the over-all compactness achieved through modern coordinated design, all contribute to maximum steam output per square foot of useful floor space. Added to these notable design features is the concept of standardized engineering that has proved so eminently successful in the hundreds of C-E Type VP and VU-10 standard boilers currently in service.

APPEARANCE

An outstanding design invariably presents a trim, appealing appearance. The well-integrated design of the VU-55, with its modern welded casing and careful application of auxiliaries makes this boiler one to arouse pardonable pride in owner and operator alike.

APPLICATION

The C-E VU-55 Boiler has been developed to meet the needs of industry for highly efficient, com-

pletely modern boilers in the medium pressure class for steaming rates from 60,000 to 125,000 lb of steam per hour. These boilers are available for oil firing, gas firing, or combination gas and oil firing. The tangential firing principle, previously obtainable only in large, high efficiency boilers, provides optimum combustion efficiency. Arrangements featuring superheaters producing total steam temperatures up to 750 F are offered. Boilers with superheaters may have top or bottom gas outlet at the purchaser's option. Units without superheaters are arranged for bottom gas outlet only. The complete line of C-E VU-55 Boilers features both inner and outer metal casings. The all-welded, inner "skin" casing permits pressure firing with its attendant advantages of reduced operating costs and lower capital expenditures. Whether pressure-fired, or operated at balanced draft, there can be no dilution of combustion products by air leakage nor emission of gas into the boiler room.

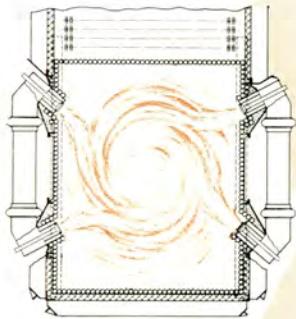
PERFORMANCE

The same high standards of performance are maintained through the entire line of VU-55 Boilers by adjusting the width of the boiler to the mass flow of gas for each size. Since the gas enters the tube bank across the entire width of the boiler, each foot of boiler width absorbs the same amount of heat. Some of the advantages of this arrangement are:

- Uniform expansion of pressure parts.
- Improved performance in handling rapid load swings.
- High sustained output with dry steam production at all steaming rates.

Tangential firing with fixed tangential burners, designed and manufactured by Combustion Engineering, add to the outstanding performance inherent in the design of this boiler. With tangential firing, efficient mixing of air and fuel occurs in the furnace instead of just at the burner. This arrangement makes the VU-55 a completely coordinated unit for the best possible performance of the burner-furnace-boiler team.

VU-55 HIGHLIGHTS



TANGENTIAL FIRING

The C-E Tangential Burner, formerly available only for much larger and more expensive boilers, has been redesigned especially for application to the VU-55 for completeness of combustion and increased efficiency. No other boiler in the range of the VU-55 offers the benefits of tangential firing.



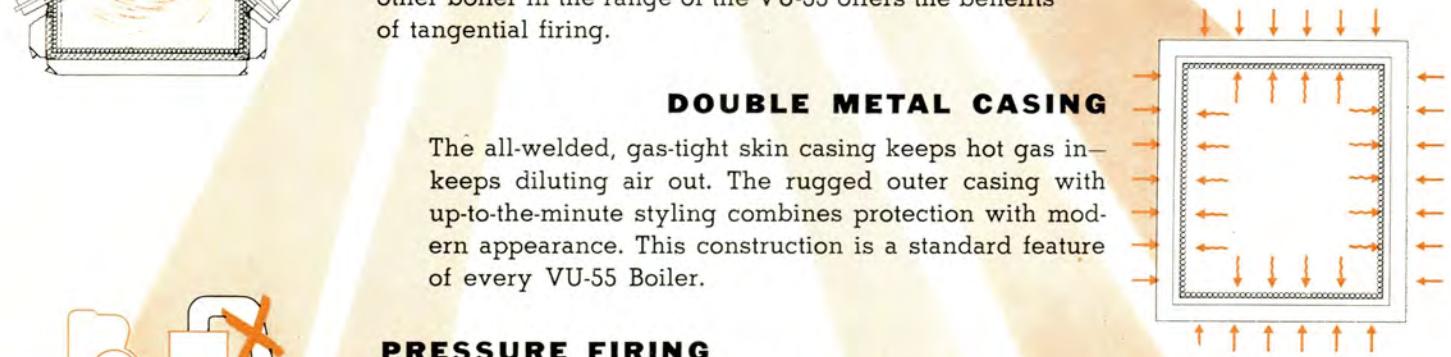
PRESSURE FIRING

This boiler has been designed for either conventional balanced draft or pressure firing. Modern pressure-fired boilers do not require induced draft fans. Initial cost, operating cost, maintenance expense, noise and vibration—all these drawbacks of induced draft fans may be forgotten with pressure firing.



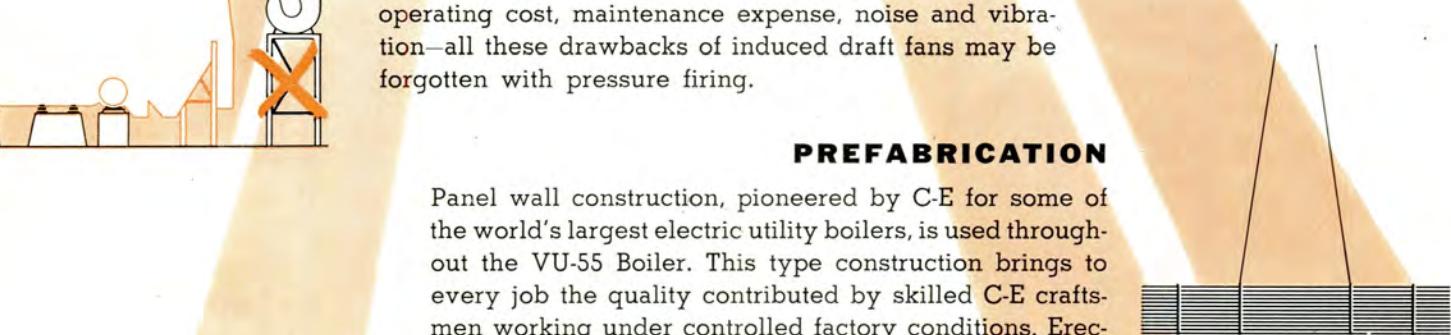
BOTTOM SUPPORT

The VU-55 Boiler presents no structural steel problems encountered in many competing boilers. It requires only simple footings under headers and the lower drum. Here again, erection time and costs are kept to a minimum with the VU-55.



DOUBLE METAL CASING

The all-welded, gas-tight skin casing keeps hot gas in—keeps diluting air out. The rugged outer casing with up-to-the-minute styling combines protection with modern appearance. This construction is a standard feature of every VU-55 Boiler.



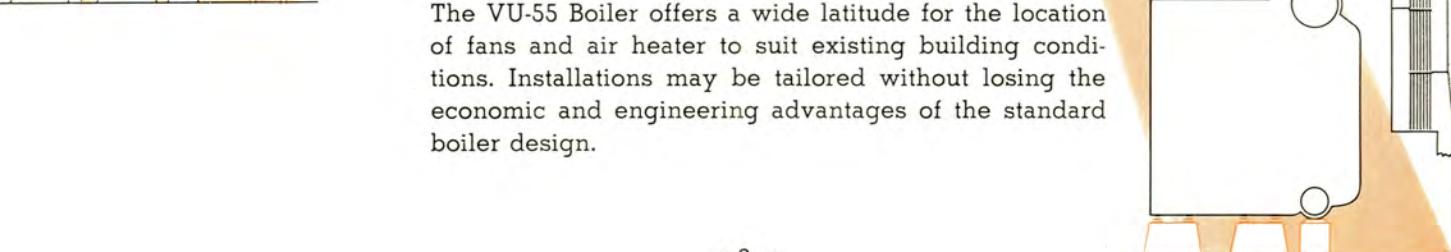
PREFABRICATION

Panel wall construction, pioneered by C-E for some of the world's largest electric utility boilers, is used throughout the VU-55 Boiler. This type construction brings to every job the quality contributed by skilled C-E craftsmen working under controlled factory conditions. Erection time and labor costs are drastically reduced.



ADAPTABLE

The VU-55 Boiler offers a wide latitude for the location of fans and air heater to suit existing building conditions. Installations may be tailored without losing the economic and engineering advantages of the standard boiler design.



BASIC DESIGN

The arrangements shown in Figs. 2, 3 and 4 are the basis for the line of C-E Type VU-55 Boilers. No external supporting steel is required. All units are supported at the bottom, requiring only simple footings under the headers and lower drum. The streamlined appearance of the VU-55 is emphasized by absence of outside downcomers, front wall headers and a minimum of side wall air ducts. The side wall headers are fed from the bottom drum. The forced draft air duct beneath the boiler also contributes to the simplicity of the design. The tangent tube furnace design provides a completely "black" furnace (except for the tile-covered floor tubes) capable of high heat absorption rates. This construction permits the use of a smaller, more economical furnace without exceeding acceptable furnace exit gas temperatures. In the VU-55 the hot gas is maintained in intimate contact with the convection surfaces by means of a virtually leak-proof baffle arrangement.

There can be no short-circuiting, by-passing or trapping of gas in this unit. The design assures streamlined gas flow. The three variations of the basic VU-55 design shown at the right lend a high degree of adaptability to obtain the most advantageous application of these boilers. There is a wide latitude in the design for the location of fans and air heater to suit existing space conditions. VU-55 Boilers which do not require air heaters are not handicapped with awkward fan arrangements which may be necessary with boilers designed exclusively for air heater application. "Tailor-made" installations may be made without losing the economic advantages inherent in the design of the VU-55. For the generation of superheated steam, the VU-55 is equipped with a C-E all-welded superheater capable of raising the steam temperature to the standard maximum of 750 F. The pendant type superheater is installed in the space between the first and second baffles. The superheater headers are outside the setting protected from the hot gas stream.

LOW MAINTENANCE COSTS

Every phase of the design of the VU-55 series has been influenced by the consideration of low maintenance costs. For instance, refractories, a troublesome cause of continual maintenance, have been kept to a minimum by the tangent tube furnace construction. This careful, farsighted furnace design plus the attention given all the other construction details assures a long, trouble-free life with minimum maintenance costs for any VU-55 Boiler installation.

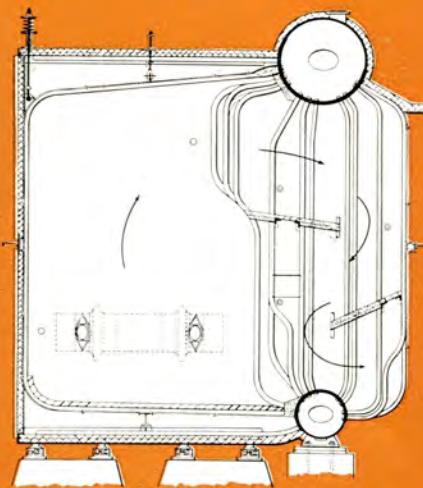


Fig. 2. Arrangement of C-E VU-55 Boiler for saturated steam showing cross-flow baffling and bottom gas outlet.

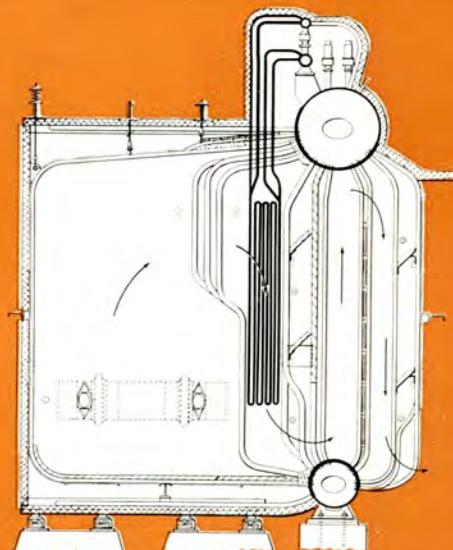


Fig. 3. Arrangement of C-E VU-55 Boiler for superheated steam showing parallel flow baffling and bottom gas outlet.

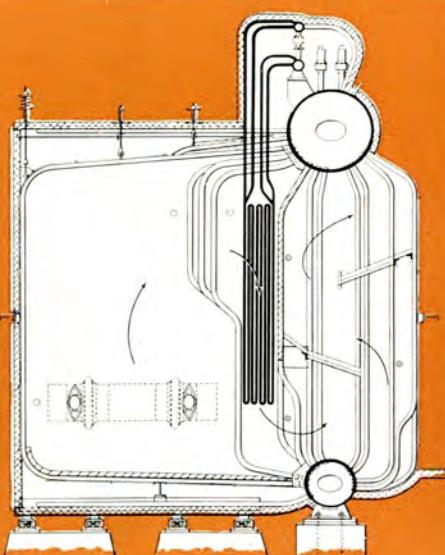


Fig. 4. Arrangement of C-E VU-55 Boiler for superheated steam showing cross-flow baffling and top gas outlet.

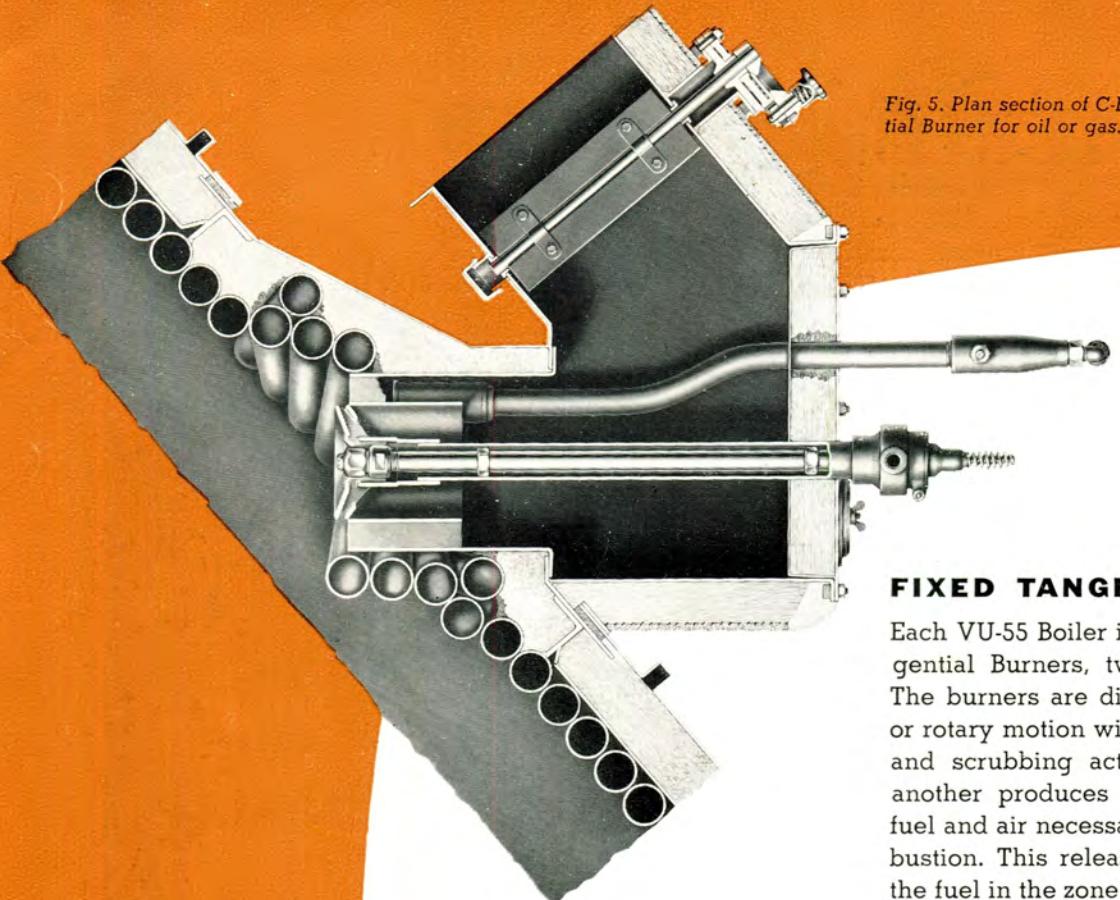


Fig. 5. Plan section of C-E Tangential Burner for oil or gas.

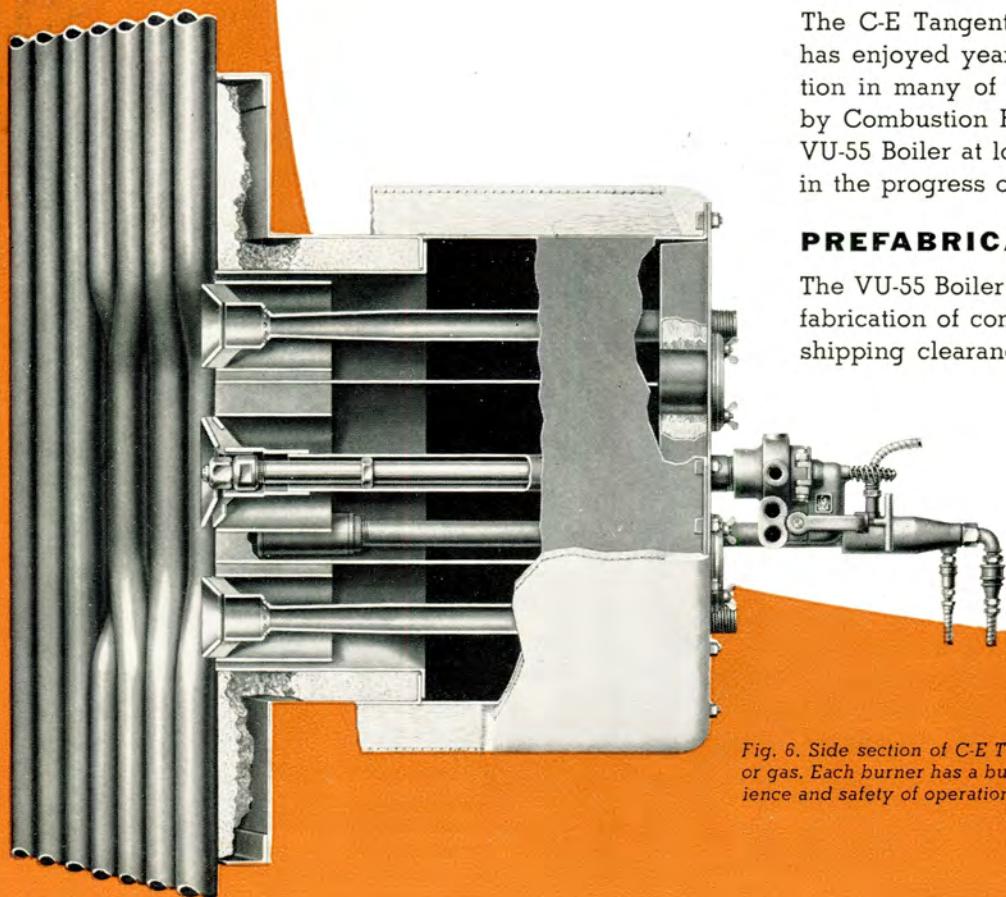


Fig. 6. Side section of C-E Tangential Burner for oil or gas. Each burner has a built-in ignitor for convenience and safety of operation.

FIXED TANGENTIAL BURNERS

Each VU-55 Boiler is fitted with four fixed C-E Tangential Burners, two in each furnace side wall. The burners are directed so as to obtain cyclonic or rotary motion within the furnace. The impinging and scrubbing action of the streams upon one another produces the turbulence and mixing of fuel and air necessary for rapid and complete combustion. This releases nearly all of the heat from the fuel in the zone of the burners so that it is available for radiant absorption by the maximum amount of waterwall surface. Complete utilization of the furnace envelope and uniformity of flame distribution allow higher average heat absorption without hot spots.

The C-E Tangential Burner for oil and gas firing has enjoyed years of eminently successful operation in many of the largest boilers manufactured by Combustion Engineering. Its adaptation to the VU-55 Boiler at low cost is an important milestone in the progress of modern boiler design.

PREFABRICATION

The VU-55 Boiler has been designed to allow shop fabrication of complete sub-assemblies as large as shipping clearances permit. This has had the net

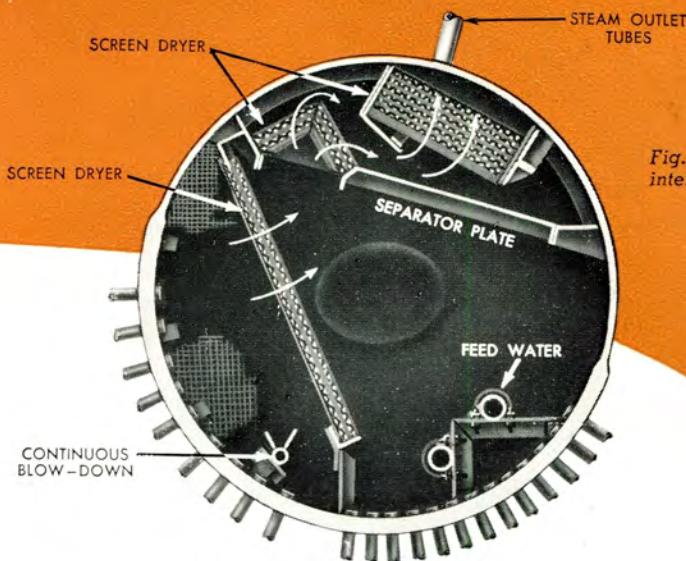


Fig. 7. Cross-section through drum showing internals.

effect of improved quality control by skilled C-E craftsmen and reduced time and costs of erection.

The side walls are shipped as an assembly consisting of headers, tubes, burner nozzles and skin casing. The D-tubes which make up the roof, front wall and floor are shipped as a four-component assembly complete with skin casing. The rear furnace wall is a two-section assembly with the ceiling rods welded to the vertical section. The rear boiler tube wall is a complete assembly partially skin-cased.

STEAM DRUM INTERNALS

The 60-in. diameter steam drum assures an adequate steam reservoir and minimizes water level fluctuations during sudden changes in steam demand. Compactly designed drum internals assure high quality steam production. The design of these internals is the result of many years of experience in the development of a truly functional product without any cumbersome parts in the water space. C-E drum internals are simple to install and require practically no maintenance.

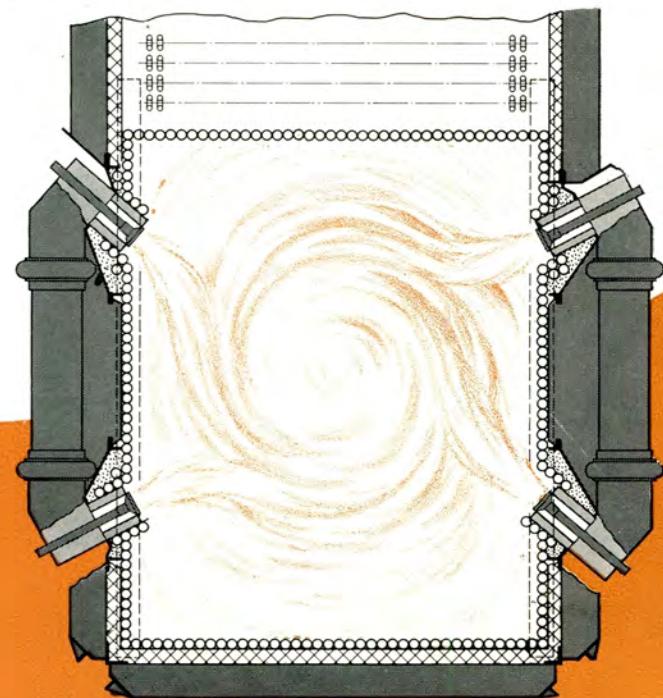


Fig. 8. Plan section at furnace corner.

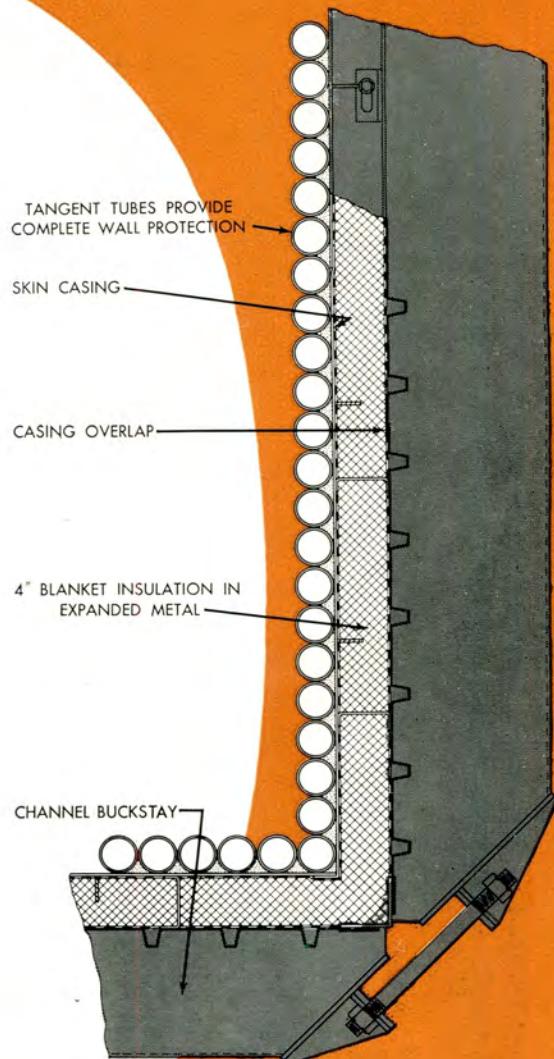
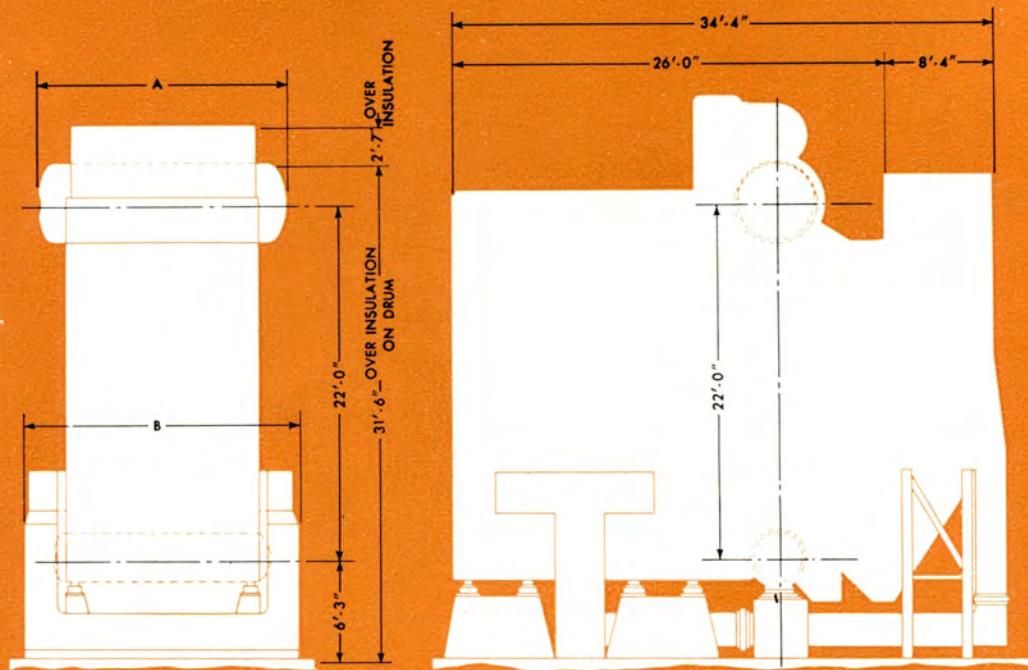


Fig. 9. Plan section showing arrangement of burners.

Fig. 10. Diagram showing overall dimensions.



OUTSIDE DIMENSIONS

BOILER DESIGNATION	A	B
80 VU-55	13 ft. 6 in.	15 ft. 3 in.
90 VU-55	14 ft. 6 in.	16 ft. 3 in.
115 VU-55	15 ft. 6 in.	17 ft. 3 in.
130 VU-55	16 ft. 6 in.	18 ft. 3 in.
155 VU-55	17 ft. 6 in.	19 ft. 3 in.

TUBE DATA

LOCATION	OUTSIDE DIAMETER	SPACING	TYPE
*Furnace front wall, roof and floor	3 in.	Tangent	Plain
Furnace side walls (swaged to $2\frac{1}{8}$ in. diameter at headers)	3 in.	Tangent	Plain
*Convection bank, 1st row	3 in.	Tangent	Plain
Convection bank, 2nd and 3rd rows	3 in.	$6\frac{1}{16}$ in.	Plain
Convection bank, 12 rows	2 in.	$3\frac{3}{4}$ in.	Plain
Boiler sides	2 in.	$5\frac{1}{16}$ in.	Finned
Rear boiler wall	2 in.	$3\frac{3}{4}$ in.	Finned
*Tubes entering lower drum swaged to 2 in. diameter			

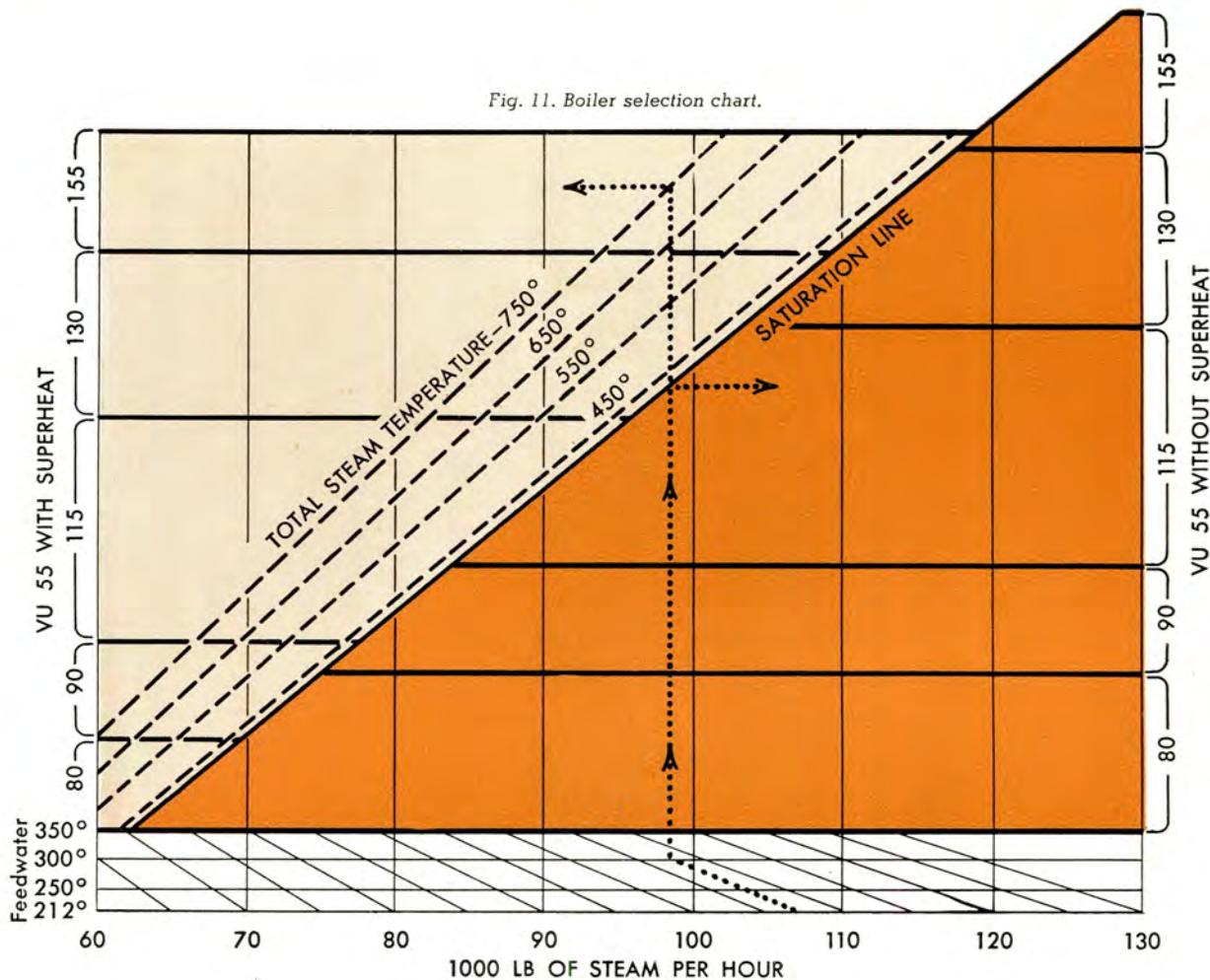
BOILER AND FURNACE DATA FOR SATURATED STEAM

BOILER DESIGNATION	FURNACE WIDTH	FURNACE DEPTH (front to rear)	FURNACE VOLUME (cubic feet)	HEATING SURFACE—SQ. FT.		
				FURNACE	BOILER	TOTAL
80 VU-55	9 ft. $1\frac{1}{8}$ in.	14 ft. $1\frac{3}{4}$ in.	2400	1680	5160	6840
90 VU-55	10 ft. $1\frac{1}{4}$ in.	14 ft. $1\frac{3}{4}$ in.	2680	1770	5670	7440
115 VU-55	11 ft. $1\frac{1}{8}$ in.	14 ft. $1\frac{3}{4}$ in.	2940	1870	6180	8050
130 VU-55	12 ft. $1\frac{1}{2}$ in.	14 ft. $1\frac{3}{4}$ in.	3210	1960	6710	8670
155 VU-55	13 ft. $1\frac{1}{8}$ in.	14 ft. $1\frac{3}{4}$ in.	3470	2050	7220	9270

BOILER AND FURNACE DATA FOR SUPERHEATED STEAM

BOILER DESIGNATION	FURNACE WIDTH	FURNACE DEPTH (front to rear)	FURNACE VOLUME (cubic feet)	HEATING SURFACE—SQ. FT.		
				FURNACE	BOILER	TOTAL
80 VU-55	9 ft. $1\frac{1}{8}$ in.	13 ft. $1\frac{1}{8}$ in.	2200	1680	5260	6940
90 VU-55	10 ft. $1\frac{1}{4}$ in.	13 ft. $1\frac{1}{8}$ in.	2480	1770	5790	7560
115 VU-55	11 ft. $1\frac{1}{8}$ in.	13 ft. $1\frac{1}{8}$ in.	2720	1870	6300	8170
130 VU-55	12 ft. $1\frac{1}{2}$ in.	13 ft. $1\frac{1}{8}$ in.	2970	1960	6830	8790
155 VU-55	13 ft. $1\frac{1}{8}$ in.	13 ft. $1\frac{1}{8}$ in.	3210	2050	7360	9410

Fig. 11. Boiler selection chart.



AIR HEATERS

The standard air heater for the VU-55 line is the tubular type designed and fabricated by Combustion Engineering. This air heater is shown in Fig. 1 and is included in the dimensional drawing, Fig. 10. Ljungstrom regenerative type air heaters are also available in standard sizes. Space requirements for the regenerative type air heater are approximately the same as for the tubular type.

STANDARD BOILER SIZES

The VU-55 Boiler is available in five sizes: 80, 90, 115, 130 and 155, which cover the range from 60,000 to 125,000 lb of steam per hour. These standard units are offered at design pressures of 250 psi and 500 psi for saturated steam or for superheated steam up to a total steam temperature of 750 F. The chart, Fig. 11, indicates the approximate boiler selection in both saturated and superheated steam applications for various steam temperatures and feedwater temperatures. For simplicity, the chart has been based on an average operating pressure of 325 psi. Since the variation of output with operating pres-

sure is not great, the chart affords a good approximation for boiler selection.

USE OF THE CHART

For example, to select a VU-55 Boiler for 107,000 lb of saturated steam per hour at a feedwater temperature of 300 F, enter the chart at the bottom at 107,000 lb per hour, proceed parallel to the diagonal feedwater temperature lines to a temperature of 300 F and then vertically to an intersection with the saturated steam line. This intersection falls in the 115 area, indicating the use of a 115 VU-55 for this service. For the same output with superheat to 750 F total steam temperature at a feedwater temperature of 300 F, enter the chart at the bottom at 107,000 lb per hour, proceed parallel to the feedwater temperature to the 300 F line, and then vertically to an intersection with the 750 F line of total steam temperature. This intersection indicates the selection of a 155 VU-55 with superheater.

Information on special design modifications involving higher pressure and temperature will be furnished on request.

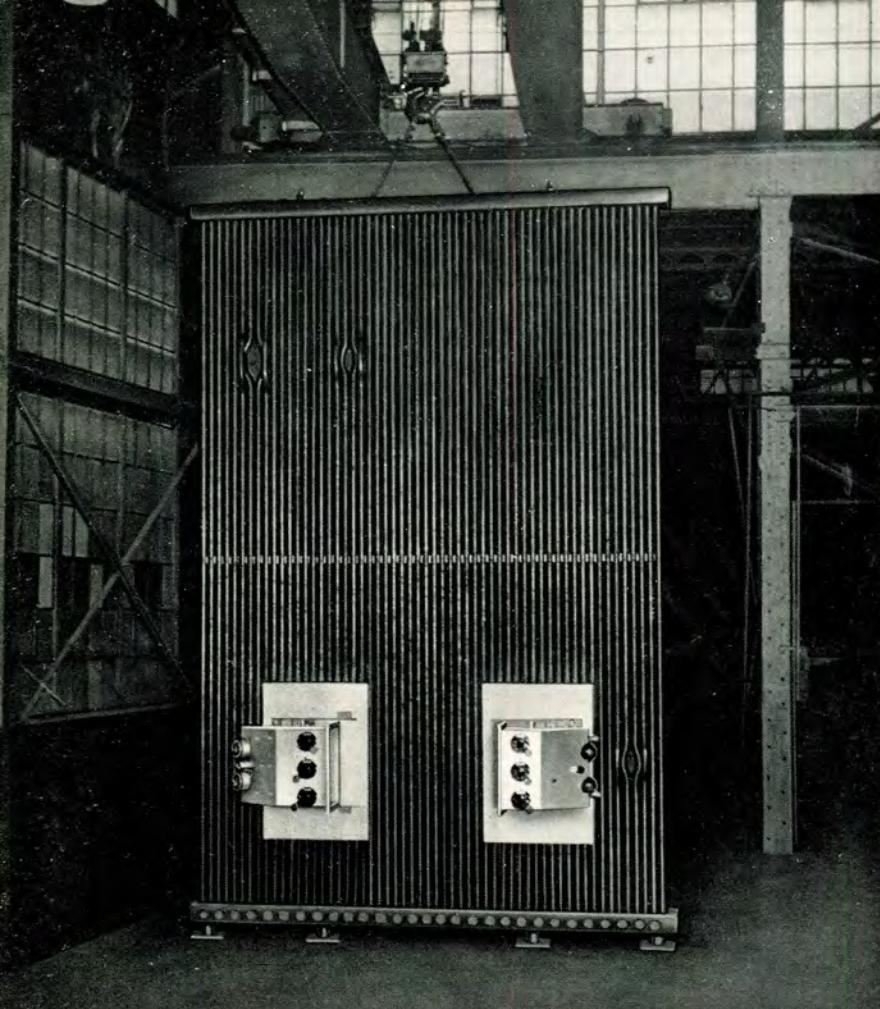


Fig. 12. Shop view of outside of sidewall panel including top and bottom headers and tangential burners.

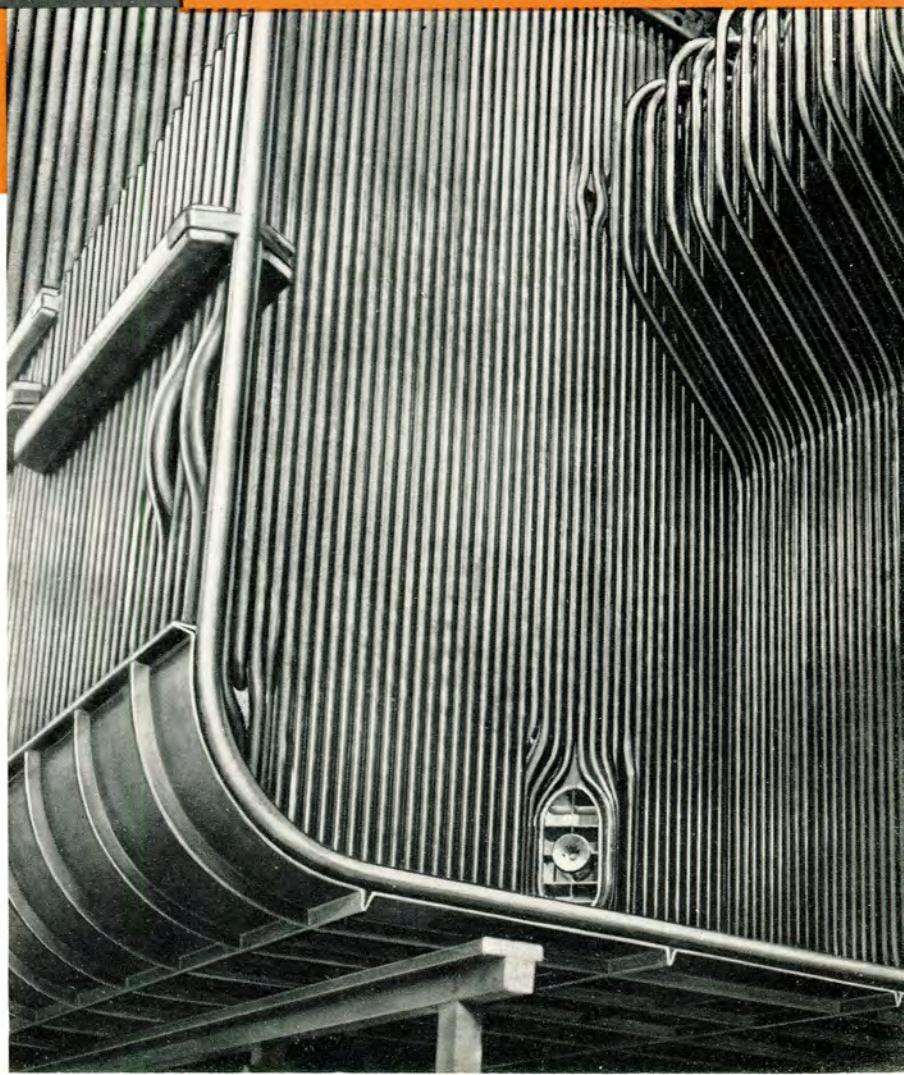


Fig. 13. View of partly constructed furnace including sidewall panel complete with header and burners. The two panel sections which make up the rear furnace wall have been erected at the right. The lower panels of the D-tube walls comprising the floor, front wall and roof have been installed. The skin casing for the floor and lower front wall is in place.

PRODUCTS*

FOR STATIONARY AND MARINE POWER PLANTS

Complete steam generating units of standard, special and package designs providing for capacity requirements from 5,000 to 2,000,000 or more pounds of steam per hour and for firing by coal, oil or gas separately or in combination. Line includes all types of boilers (natural and controlled circulation), as well as controlled circulation hot water boilers. Boiler components include superheaters, reheaters, economizers and air preheaters. Fuel preparation and firing equipment includes pulverizers and burners as well as a complete line of stokers. Nuclear power reactors and components.

FOR PROCESS INDUSTRIES

Mills, pulverizers, air separators, flash drying systems and fluid bed dryers. Pressure vessels, columns, cracking towers, tanks.

FOR PULP AND PAPER MILLS

Units for recovery of chemicals and waste heat. Flash drying systems for lime kiln mud. Bark burning boiler units. Calcining systems for lime mud.

FOR MUNICIPALITIES

Flash drying and incineration systems for sewage sludge. Flash drying and calcining systems for water softening sludge. Refuse incinerators.

FOR RAILROADS

Superheaters, steam driers, feedwater heaters, exhaust steam injectors, pyrometers, flue washers, thermostatic heater valves and welded boiler shells for steam locomotives.

FOR HOMES

"Superspun" soil pipe and fittings.

*Above list includes products known by following trade names: C-E, Elesco, Type VU, Vertical-Unit, Heine, Ladd, Walsh-Weidner, Casey-Hedges, Raymond, Lopulco, Coxe, Green, Type E, Skelly, Low Ram, and Superspun.

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(See also list of Associated Companies)

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FINLAND, Helsinki, Oy. Exim Ab., Lonnrotsg 7
FORMOSA, Federal Eastern Corporation, 150 Broadway, New York 38, New York
(Lien Chen Limited 33, Wu Chong Jie, First Section, Taipei, Formosa)
F.W.I., Guadeloupe, Usine-Grosse Montagne, Lamentin
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HAWAII, Honolulu 1, American Factors, Ltd., P. O. Box 3230
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INDIA, Madras, J. Stone & Co. (India) Private Ltd., 4-A, Sir Desikachari Rd., Mylapore
INDIA, New Delhi, J. Stone & Co. (India) Private Ltd., P. O. Box 473
ISRAEL, Palestine Economic Corp. of New York, 18 E. 41st Street, New York 17, N. Y.
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OUTSIDE U. S. A.—Canada, England and France.
MANUFACTURING LICENSEES—Argentina, Brazil, England, France, Germany, Holland, India, Italy, Japan, Norway and Sweden.



C-E Manufacturing Divisions

- 1. CHATTANOOGA, TENN. (Plant No. 1)
- 2. CHATTANOOGA, TENN. (Plant No. 2)
- 3. EAST CHICAGO, IND.
- 4. CHICAGO, ILL.
- 5. ST. LOUIS, MO.
- 6. MONONGAHELA, PA.

